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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,890	03/22/2004	Padmapani C. Nallan	7017	1896
44182	7590	04/17/2006	CI/ETCH/METAL-NVM/JB	
PATTERSON & SHERIDAN, LLP APPLIED MATERIALS INC 595 SHREWSBURY AVE SUITE 100 SHREWSBURY, NJ 07702			EXAMINER	
			TRAN, BINH X	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 04/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/805,890

Applicant(s)

NALLAN ET AL.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18, 21 and 22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18, 21 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Terminal Disclaimer

1. The terminal disclaimer filed on 2-23-2006 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 6,806,095 has been reviewed and is NOT accepted.

An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c).

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 1-15, 17, 21-22 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-17 of U.S. Patent No. 6,806,095. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of US 6,806,095 is narrower than the current application (10/805,890) claims by further disclose the dielectric constant of the dielectric material is greater than 4. However, the dielectric material for both US 6,806,095 and the claims of current application is identical. Dielectric constant is a property of the material. A chemical composition and its properties are inseparable.

4. Claims 1-15, 17, 21-22 provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-7, 9-20 of copending Application No. 10/143,397. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims copending application 10/143,397 is narrower than the current application (10/805,890) claims by further disclose the dielectric constant of the dielectric material is greater than 4. However, the dielectric material for both US 6,806,095 and the claims of current application is identical. Dielectric constant is a property of the material. A chemical composition and its properties are inseparable.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-4, 6, 8, 12-18, 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moise et al. (US 2001/0055852) in view of Jeon (US 6,790,755).

Respect to claim 1, 12, 17, and 21, Moise discloses a method for etching comprising the step of:

introducing into an etch chamber a substrate having a dielectric material (such as PZT);

providing into the etch chamber a process gas comprising CO and Cl₂
(paragraph 0159, 0160, 0166);

expose the dielectric material to a plasma formed from the process gas.

Moise further discloses it is possible to replace PZT with Hf containing material as an alternate material (paragraph 0148). Moise fails to disclose the dielectric material is TaO₂ (aka tantalum oxide) or ZrO₂ (aka zirconium oxide) or ZrSiO₂ (aka zirconium

silicate), or HfSiO_2 (aka hafnium silicate). However, Moise clearly teaches to use high-k dielectric material including PZT. In a method for making semiconductor device, Jeon teaches to use PZT, tantalum oxide, zirconium oxide, zirconium silicate or hafnium silicate as a high-k dielectric material. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Moise in view of Jeon by using tantalum oxide, zirconium oxide, zirconium silicate or hafnium silicate because equivalent and substitution of one for the other would produce an expected result.

Respect to claims 2-4, and 22 Moise discloses to use Cl_2 gas (paragraph 0159, 0160, 0166). Respect to claim 6, Moise discloses the step of maintaining a gas pressure of 10 mtorr (paragraph 0097, read on applicant's range of 2-100 mtorr). Respect to claim 8, Moise discloses applying a bias power to a cathode electrode of 0-1000 Watts (Fig 1a, read on applicant's range).

Respect to claims 13-14, Moise discloses the step of maintaining a temperature of 250-400 °C during etching (paragraph 0205, read on applicant's claimed range). The limitation of claims 15, 18 and 22 has been discussed above under Moise's reference. Respect to claim 16, Moise teaches to use HCl as a chlorine source (table in paragraph 0160). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Moise by etching Hafnium containing material with CO and chlorine because equivalent and substitution of one for the other would produce an expected result.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moise in view of Jeon as applied to claim 1-6 above, and further in view of Xing (US 6,492,222).

Claim 7 differs from Moise and Jeon by the specific pressure value. In a plasma etching method for high-k dielectric material, Xing discloses that the plasma process pressure is a result effective variables (Table 2-6). Xing further discloses teaches to adjust the pressure value in order to control etch rate (Table 5). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal pressure as an result.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moise in view of Jeon as applied to claim 1-6 above, and further in view of Fujikawa et al. (US 6,764,972).

Claim 9 differs from Moise and Jeon by the specific bias power value. However, Moise clearly teaches to control the bias power between 0-1000 Watts (Fig 1a). In a plasma etching method, Fujikawa discloses that the bias power value is a result effective variables vary from 10-25 Watts (col. 7-8, within applicants value). The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal bias power as an expected result.

10. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moise in view of Jeon as applied to claim 1-6 above, and further in view of Hart et al. (US 2002/0142609).

Claim 10 differs from Moise and Jeon by the specific inductive source power. However, Moise clearly teaches to use inductive couple plasma (ICP, See paragraph 122). In a plasma etching method, Hart discloses inductive source power is a result effective variable. Hart further discloses to control the source power of 800 watts to 3.5 kilowatts (paragraph 0045, within applicant's range of 200-2500 Watts). The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal results.

Allowable Subject Matter

11. Claim 5, 11 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, along with filing of an acceptable terminal disclaimer.

Response to Arguments

12. The examiner still maintains the double patent rejection base on US 6,806,095 because terminal disclaimer is not accepted (See Terminal Disclaimer Section for further detail).

The applicants argue, "Moise teaches to etch PZT using Cl₂, O₂, CF₄ and Ar (paragraph [0159] and [0167]), or etch PZT and SBT using Cl₂ and O₂ (paragraph [0173]). According to applicants, Moise does not teach, show or suggest a method of

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plasma etching using carbon monoxide and a halogen gas. The examiner strongly disagrees. In the table of paragraph [0160], Moise show that the oxygen source gas can be O₂ or CO (aka carbon monoxide) and well as halogen gas (i.e. Cl₂). Thus, the examiner still maintains that Moise teaches a plasma etching using carbon monoxide and halogen gas.

The applicants further argue that "Jeon teaches to annealing these layers [high-k dielectric layer], but is silent as to etching high-k dielectric layers". The examiner disagrees. The examiner recognizes that Jeon mainly teaches to annealing high-k dielectric material. However, in Figure 1 Jeon clearly show a gate stack of a MOSFET device comprises high-k dielectric material. Further, in Figure 10 Jeon clearly discloses "continuation fabrication of semiconductor device" step (i.e. Step S1004) after the annealing step. It is not possible to form a gate stack with an etching step. An etching step must be occurred in order form the structure in Figure 1 of Jeon. Thus, the examiner still maintains Jeon is a proper prior art, since Jeon implicitly discloses an etching step.

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh Tran

Binh X. Tran